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Some Aspects of Radiology, with Suggestions for its Application to Veterinary Surgery.

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(Presented to the Lancashire V.M.A.)

Mr. President and Gentlemen,

It is with extreme diffidence and considerable trepidation that I come to speak to you of radiology as applied to a subject of which practically all of you present know considerably more than I do myself. As a medical man my activities up to the present have been concerned entirely with the medical application of radiology, but I fully appreciate its enormous possibilities and the extensive field of investigation opened by its intelligent use in connection with veterinary surgery.

Do not let it be supposed for one moment that radiology is going to supplant the methods of diagnosis and treatment at present in use—it will not; but if used in conjunction with other modes of investigation; must prove a valuable means of confirmation of diagnosis made by other means. It is of still more value in "doubtful cases"—those in which the clinical symptoms are indefinite or obscure, or when there is a question of differential diagnosis to be considered, and in medical practice it frequently becomes the deciding factor in the conduct and treatment of cases.

During the course of this paper I propose to deal with the history of radiology, the production of X-rays and X-ray apparatus. I shall then discuss in detail the radiological appearances seen in certain injuries and diseases met with in the human being, and finally offer some suggestions as to the lines of investigation which might be followed with advantage in the building up of a science which in its application to veterinary surgery is at present in its infancy.

PRODUCTION OF X-RAYS.

(1) **HISTORY.** The discovery of X-rays was made by Rontgen in April, 1895. He had been led to this discovery by the work of Lenard, and Lenard, in common with many other scientists, was following the lead of Sir William Crooks. The discovery, therefore, goes back to the invention of Crooks's vacuum tubes, to be described later. It was advanced by the work of Stokes and others on fluorescence.

The actual discovery was accidental, like other epoch-marking discoveries in science.

During the course of a search for invisible light rays, Rontgen passed an electric current through a low-pressure discharge tube, which was completely enclosed in black paper, when a fluorescent screen which was in the vicinity of the tube was seen to fluoresce brightly while the tube was in action; obviously some unknown radiation was at work, and Rontgen quickly realised that he was dealing with a new agent. Further experiments led to the discovery of the new radiation, which he promptly designated as X-rays, and the name has remained from that time.

In this way one of the most important discoveries in physics has been made—one which in itself has gone far to revolutionise our conceptions of matter, and which has in the short period of twenty-five years developed new and invaluable aids in practical medicine, both diagnostic and therapeutic.

Following this discovery experimental investigation was taken up with enthusiasm. It was shown that the rays were able to pass through many objects opaque to light, such as cardboard, wood, wax, and certain metals. Furthermore, it was noticed that the power of penetration of the rays varied inversely with the atomic weights or densities of the substances used; in other words, the rays passed readily through substances of low atomic weight such as wood, wax, etc., while those of higher atomic weight cast a shadow on a fluorescent screen when placed between it and the source of the rays. The higher the atomic weight of the metal used the denser was the shadow, until a point was reached at which no appreciable number of rays passed through the metal at all. This was found to be so in the case of such substances as bismuth and lead, which have atomic weights of 206 and 205 respectively.

Further investigation showed that if a hand or foot were placed between the rays and a fluorescent screen, the shadows of the bones were well defined on the screen, while those of the fleshy or soft parts, being of small atomic weight compared with the calcium of the bones, were, for all practical purposes, non-existent.

The practical importance of this discovery was immediately realised by the medical profession, and the demand for suitable apparatus stimulated the interest of certain physicists in this direction, with the result that the development of radiology and the increasing knowledge of the nature and properties of X-rays (with consequent improvement of apparatus), have advanced side by side until a state of

efficiency has been reached far beyond the most sanguine hopes of the early workers.

Attention was first directed towards injuries and diseases of bone and the localisation of metal foreign bodies, such as swallowed coins, buttons, etc. It was noticed that certain stones which occasionally appear in the kidneys and bladder, as the result of disease, and which contain salts of calcium, of relatively high atomic weight, could be demonstrated by the rays. This led to a development of its use in genito-urinary work.

Finally, it was discovered that if a meal containing bismuth were administered and watched during its passage through the stomach and intestines, the whole of the alimentary tract from the mouth to the anus could be outlined and any irregularity in its appearance noted.

(2) PHYSICS. In order to appreciate the true nature of X-rays, it will be necessary to enter briefly into the physics of electricity. Let us commence with the electric spark. Air at atmospheric pressure is a good insulator of electricity. By very delicate methods it can be shown that the insulation is not quite perfect; but the leakage from a conductor surrounded by air is extremely small, on the other hand, the existence of an electric field puts the molecules of air under strain, and if the field is too great, the insulation breaks down and a spark passes.

The maximum field that air can sustain at its ordinary pressure and temperature is about 30,000 volts per centimetre. If the field rises beyond this value, a spark discharge takes place.

The potential difference required to produce a spark decreases as the pressure of the air becomes less. The experiment can be carried out in a long glass tube, known as a discharge tube, which is sealed at both ends and connected by a side tube to an exhaust pump. Electrodes, usually in the form of small aluminium discs, are sealed into the ends of the tube and connected by platinum wires. These wires are connected to the secondary terminals of a small induction coil. As the tube is gradually exhausted it will be found that the discharge takes place more and more readily. The spark at the same time becomes wider, more diffuse, and more continuous, until at a pressure of a few mms. of mercury the whole tube becomes filled with a continuous reddish glow. At this stage the difference of potential necessary to maintain the discharge is reduced to a few hundred volts.

If the tube is still further exhausted by means of a vacuum pump to the pressure of about one mm. of mercury, the character of the discharge suddenly alters, the continuous glow being replaced by a series of bright and dark bands or striæ.

The surface of the cathode itself is covered with a bluish velvety glow, known as the cathode glow. Beyond this the discharge for some little distance appears dark and non-luminous. This dark portion is known as Crooks's dark space. As the pressure in the tube is still further reduced, this dark space begins to grow at the expense of the other appearances, until finally, at very small pressures indeed, it occupies the whole of the tube, except for a glow on the surface of the cathode and a little blob of light on the anode. At the same time the potential difference required to maintain a discharge through the tube rapidly increases, running up into hundreds of thousands of volts. When this stage is reached a pencil of pale blue light may be seen proceeding normally from the cathode and crossing the dark space. It is known as the cathode rays. If the tube is arranged so that the cathode rays fall upon the glass walls of the tube, the portion of the glass which receives the rays glows with a greenish yellow fluorescent light.

The cathode rays consist of negatively charged particles shot off from the negatively charged surface of the cathode with very great velocity. These cathode particles, or electrons, as they are called, are very much lighter than the lightest known atom. They may best be described as atoms of electricity. No charge smaller than that carried by an electron has been isolated, and there is evidence to prove that every charge consists of a multiple of this charge, just as every mass of a substance is made up of a whole number of atoms.

(3) X-RAYS. It was observed by Rontgen that certain radiations were given off from the walls of the discharge tube at the points where the cathode rays impinged. To these radiations, as before mentioned, he gave the name of "X-rays."

Now what are X-rays? Before answering this question, may I give a short illustration which I hope will simplify the explanation.

Doubtless most of you have noticed on a bright sunny day the scintillation of the air over the sea or over a chalk road, or a similar vibration of the air above a coke brazier. The explanation of these phenomena is simple when we realise that heat travels in waves. The vibrations we see from the brazier are in reality heat waves, as also are those above the sea and road; in the latter cases the source of the incident heat waves is the sun.

Waves of light, or vibrations in ether, as they are called, are of shorter wave length than those which give heat, but otherwise are exactly similar in nature. Still shorter wave lengths give rise to a more intense light such as that seen in ultra-violet rays emitted by certain arc lamps. Thus, if the vibrations in ether become sufficiently short, in other words, if the wave lengths become sufficiently small, we see produced what Rontgen called X-rays. X-rays, therefore, are vibrations in ether of extremely short wave length.

Further experiments have disclosed the fact that, having reached the stage where X-rays are produced, if the wave length is further shortened, the rays become progressively more intense in their power of penetration, until ultimately we come to the rays produced by radium, which have the shortest wave length and the greatest penetration that has yet been discovered.

The wave length of a beam of light is of the order of 1/105 cms., or 1/100,000 cms., while that of X-ray is of the order of 1/10 cms., or 1/100,000,000 cms.

It will thus be seen that the wave length of a beam of X-rays is extremely small.

The properties of X-rays have been dealt with briefly. There are two other facts I should like to mention. The first is the power of the rays to affect a photographic plate. Knowing as we now do the close analogy between light and X-rays, it is easy to understand that, just as a photograph of an object can be obtained by light on a photographic plate, so a photograph of bone, for example, can be obtained on a similar plate, the only difference being that in the latter case more penetration is required, and this is provided by the rays. The other point is that the rays when once produced travel in straight lines, hence an object placed on a plate will produce a perfectly clear and well-defined image if subjected to the rays from an X-ray tube. Were the rays not travelling in straight lines, the image would be blurred.

Production of the Rays.

We now come to the actual production of the rays, the essentials for which consist of :—

(1) A source of electrical energy.

(2) A means of transforming a current of low voltage and comparatively high amperage into one of high voltage and low amperage.

(3) A mechanical interrupter.

(4) An X-ray tube.

(5) A fluorescent screen or photographic plate for utilising the rays thus produced.

1. The source of electrical energy generally used in England is the ordinary electric main, which varies in different districts, and may be either a direct or alternating current. It also varies in the output of volts and amperes. In Manchester, for instance, the supply is direct, with a voltage of 200 and an amperage of 15. For X-ray purposes this is transformed into voltages varying from approximately 80,000 volts to 180,000 and from one milliampere (1/1,000 of an ampere) to 50 or 60 milliamperes.

2. This transformation is carried out by means of the X-ray coil, which is nothing more or less than a large edition of the small induction coil used in elementary physics, and of exactly the same construction. It consists of a central iron core. surrounded by two distinct coils termed the primary and secondary coils respectively. The primary consists of a number of turns of thick copper wire ; the secondary of many thousands of turns of very fine wire.

3. The mechanical interrupter, as its name implies, is a device for interrupting very rapidly the supplying current. I do not propose to describe this piece of apparatus in detail.

4. The X-ray tube consists of a spherical glass bulb varying in diameter from 5ins. to 10ins. with three cylindrical projections. Its contents consist of an anode, a cathode (which acts as the negative terminal), and an anti-cathode, which serves as the positive terminal. The latter ends in a spherical surface of tungsten in the centre of the bulb, its focal point in the same horizontal plane as the centre of the cathode, and its surface at an angle of 45 degrees, with a line drawn through the horizontal plane.

Before use almost all the air is removed from the tube by means of a powerful vacuum pump.

In order to generate the rays, the two wires from the main are connected to the primary winding of the induction coil through the mechanical interrupter, while wires from the secondary winding pass to the anti-cathode of the tube, and by way of the cathode back to the coil, thus completing the circuit.

On switching on the current from the main, it passes first through the interrupter, which very rapidly " makes " and " breaks " the current. It then reaches the primary of the coil. Now, the effect of this rapidly interrupted current in the primary is to induce a new current in the secondary. The primary current is of low voltage and high amperage, whereas the new current produced is of high voltage and low amperage, and this is the current which passes on to the X-ray tube.

On its arrival it passes through the anti-cathode and strikes the surface of the cathode. The result, as we have seen in the case of the discharge tube of Rontgen, is the production of cathode rays, which pass back and strike the surface of the anti-cathode, their energy producing X-rays at their point of impact. The rays thus produced pass from its surface in all directions ; so that if we place an object, *e.g.*, a limb, between the anti-cathode and a fluorescent screen, the shadow of the bony portion can be clearly demonstrated.

Bones and Joints.

The application of radiology to veterinary surgery comes, I think, under two main headings :—

(1) The diagnosis of injuries and diseases of bones and joints.

(2) The treatment of certain skin diseases.

Let us first consider bones and joints.

Most bones, both in the human and in animals, consist of three distinct parts, a central shaft, and an upper and lower end, known as the upper and lower epiphysis respectively. The line of demarcation between the shaft and the upper and lower epiphyses is known as the epiphyseal line, and it is from these lines that the bones grow during infancy and early adult life.

The shaft of all bones consists of two layers surrounding a central cavity :—

(1) The outer layer—the periosteum.

(2) The inner layer—the osseous or compact tissue.

(3) The central cavity—the medullary cavity.

The periosteum is a thin covering, no thicker than a piece of paper, and is concerned chiefly with the nutrition and repair of the osseous tissue in cases of injury.

The compact tissue is the bone proper. It consists chiefly of hard salts of calcium, through which pass numerous small canals—the Haversian canals—also concerned with nutrition. This is the layer to which the bone owes its strength.

The medullary cavity is considerably larger in diameter than the compact layer. It is filled with bone marrow, and is concerned with the nutrition of the bone, and the formation of the white blood corpuscles found in the blood.

The epiphyses consist entirely of osseous tissue, and at their articular surfaces with other bones are covered with cartillage. This is not of sufficient density to show on an X-ray plate.

Injury to bone may affect either the periosteum alone, or both the periosteum and the osseous tissue. In the first case, the injury may lead to separation of a piece of the periosteum with subsequent formation of new bone between it and the osseous tissue. This condition is known as periostitis.

Injury involving both the periosteum and compact tissue is invariably severe and generally ends in fracture of the bone.

Fractures are divided into simple fracture, comminuted fracture, compound fracture, and greenstick fracture.

The simple fracture consists of a clean break across the shaft of the bone, and may be either transverse or oblique. It is frequently caused by indirect violence.

In the comminuted fracture the bone is broken into a number of small pieces. It is almost always caused by direct violence.

If one of the fractured pieces of a bone protrudes through the skin, the condition is known as a compound fracture, and may be either simple or comminuted.

Finally, there is the greenstick fracture, which occurs in young children (or animals), in which the bones are soft, being relatively poor in calcium salts. It consists of a cracking or incomplete fracture of the bone without actual separation of the fractured ends. The breaking of a green twig gives a similar appearance to that seen in these cases—hence the name greenstick fracture.

Other injuries occurring in children are separation of the epiphyses. They occur in joints, and may also be accompanied by dislocation of the bones forming the joint. At the age when the epiphyses have united with the shafts of the bones, dislocation of the bones themselves may occur with or without fracture.

Metallic foreign bodies, either in bone or the soft tissues, can be demonstrated and their actual position accurately localised.

We will now pass on to

Disease of Bone.

I have chosen the following diseases because they occur both in animals and in man, and as we know that the composition of all bone, whether human or otherwise, is the same, it follows that just as a given disease will affect the human bone so will it affect the bones of animals.

The diseases are :—

(1) Septic Infections.
(2) Osteoarthritis.
(3) Tubercular Disease.
(4) New Growths.
(5) Rickets.

(1) Septic Infections. Septic infections of bone may affect all three layers separately or simultaneously In the latter case the condition is known as *osteomyelitis*, and may be acute or chronic. The typical picture of a chronic osteomyelitis shows the following features : Areas of suppuration of the shaft indicated by patches of varying density and rarefaction of bone. Newly-formed periosteal bone shown by deposition of successive layers of bone outside the shadows of the original bone, or what remains of it.

Pieces of the original shaft become isolated and their nutrition lost. These dead pieces are known as *sequestra*. This death or necrosis of the bone is indicated by irregular patches of denser shadow, with a well-defined periphery, and generally lying in an abscess cavity, indicated by a lighter area.

(2) Osteoarthritis. This is characterised by irregular new bone formation, and always occurs in joints. The earliest change is absorption of the cartilage covering the articular ends of the bone. This is followed by thickening or lipping of the edges of the bones and the formation of bony or osteophytic outgrowths. There is no rarefaction of bone and no abscess formation, as seen in the case of tubercular disease.

(3) Tubercular Disease. This disease may affect bone alone, but more generally affects joints. A typical tubercular joint shows the following changes :

(1) Marked rarefaction of the bones forming the joint resulting in a readier passage of the rays, and a consequent increase in the effect upon the plate, appearing on the negative as darker areas.

(2) Actual loss of substance in the head of the bone.

(3) Extreme atrophy of the shaft of the bone. This is most marked when the condition has existed for any length of time.

(4) Abscess formation characterised by an increase of the normal shadow of the soft parts around the joint—accentuation and bulging of the joint outline.

(5) Necrosis of portions of the bones with formation of sequestra, readily recognised in the radiograph.

(6) Arrested development of epiphysis, and changes at the epiphyseal line, with later marked shortening of the long bones.

(7) Displacement of bones, particularly at the hip-joint. Where the head or neck of the femur is displaced upwards, this indicates that there is a marked change in the acetabulum.

(8) Ankylosis of the bones forming the joint. This condition is frequently an end result of tubercular disease of joints.

(4) New Growths. These are of two kinds—benign and malignant. Of the benign growths only *enchondromata* and *exiostoses* are discernible by

means of radiology. The former are cartilaginous in nature and occur most frequently in the short bones, *e.g.*, the hand, while the latter consist of bone and appear at the ends of long bones.

Of the malignant growths, *sarcomata* and *secondary carcinomata* are seen in the bone. The main feature seen in these cases is absorption of bone. The tumour grows at the expense of the bone tissue, thus, the larger the tumour, the greater is the absorption of bone.

Sarcoma. This may commence in the medullary cavity or compact tissue—endosteal sarcoma, and results in the so-called " expansion " of bone, which consists of an absorption of bone from within, while at the same time new osseous tissue is being deposited from the under surface of the periosteum. The X-ray plate shows a cystic appearance at the site of the tumour, while the bone above and below (except at the margins of the growth) is normal in appearance.

The other form of sarcoma frequently met with is the periosteal sarcoma. It commences in the periosteum of the bone, and extends both outwards into the soft tissues and also gradually eats its way into the compact tissue. In the earlier stages of the growth the periosteum shows some slight irregularity, with the appearance in it of small transverse spicules of bone, or striæ, as they are sometimes called. As the size of the growth increases the compact tissue gradually becomes absorbed, and the bone gives the appearance of having had a piece punched out of it.

Secondary Carcinoma of bone is always secondary to a primary infection elsewhere, e.g., in the breast.

The presence of these secondary deposits is shown radiographically by rounded irregular shadows of varying density, generally lighter than the normal bone. Occasionally necrosis occurs in these areas, giving a somewhat mottled appearance.

(5). Rickets. This is a general disease of malnutrition occurring in children, and manifesting itself in lesions connected mainly with bones. It usually commences within the first three years of life.

The chief changes are found in the neighbourhood of the epiphyses. Ordinarily the epiphyseal cartilage is a lamella of about a line in thickness. In rickets the epiphyseal cartilage is not only enlarged in circumference but also thickened and irregular. Outgrowths of cartilage project on either side into the calcified tissue. The junction between the epiphysis and the shaft becomes hollowed and irregular. The whole of the bone is stunted in appearance, and development, which normally takes place from the epiphysis, is delayed, while the shaft, being deficient in lime salts, is often deformed or misshapen.

X-ray Treatment.

In conclusion, may I say a few words about radiology as a therapeutic agent ?

Experience of this branch is comparatively small, though since the action of the rays on the body tissues was first discovered, rapid strides have been made in the treatment of many and varied diseases met with in man.

The action of the rays on the body tissues may be divided into two stages—the first, that of stimulation, and the second, that of destruction. Small doses for short periods cause stimulation—heavy doses at more frequent intervals cause destruction ; while if the dose becomes excessively heavy, actual death or necrosis of the tissue is produced, with sloughing of the affected part.

Different tissues respond in varying degrees to the action of the rays—those most early affected being the skin and the glandular tissues. There is also a marked response on the part of the cells contained in the blood. Furthermore, it is now known that tissue cells in the process of development are more readily destroyed than those fully developed, in other words, the more embryonic in type, the more readily will a cell be destroyed.

In addition to the above, the rays are credited with the power of killing off many different kinds of bacteria and infective organisms, *e.g.*, staphylococci, streptococci, the tubercle bacillus, and many organisms affecting the skin, such as those of ringworm, psoriasis, eczema, lupus, etc.

Bearing in mind the above facts it is not surprising to learn that glandular enlargements, especially if accompanied by the presence of infective organisms, respond readily to X-rays. Tubercular glands may be mentioned as an example. If these are treated early they can be made to disappear without the necessity of operation. Should operation be necessary, post-operative treatment of the areas affected generally eliminates the possibility of recurrence.

The response in the case of skin diseases is even more marked. In most cases the result is little more than magical. To give an example :—I have recently been treating a man who has suffered from eczema for many years, and has tried various remedies without much success. When I first saw him he had two large patches of " weeping " eczema, one on the back of either thigh and calf, and extending for a length of 12 inches and a breadth of about four inches. I treated him at intervals of seven days, and after the second treatment both patches had dried, though the intense ithcing which was a great source of trouble, was still present. At the end of a month the legs were quite healed and the itching negligible. This is by no means an isolated case, but it does serve to show what results one may reasonably expect to follow the judicious use of the rays in most of the skin diseases which come under our notice.

The other groups of diseases for which the rays are used therapeutically are malignant growths or cancers and those diseases affecting the composition of the blood.

Of cancer I do not propose to speak as it can be of no practical value in veterinary surgery. I should imagine that the only course open in these cases is the immediate destruction of the affected animal.

The action of X-rays on the blood concerns the cells only, the blood serum being unaffected, to the

best of our knowledge. The white cells are much more readily affected than the red, in fact doses which are sufficient to destroy white cells (in certain diseases) are capable of stimulating the increased production of red cells at the same time. In this connection I might mention in passing, that patients being treated for a disease, *e.g.*, tubercular glands, often show a marked improvement in general health while enlarged glands in parts of the body other than those being treated frequently diminish in size. The explanation of this phenomenon is said to lie in the improvement in quality and number of the red cells.

The blood disease most frequently treated in the human, is spleno-medullary leucocythæmia—a condition in which the liver and spleen are enlarged while the white blood cells rise to as many as 70,000 to 100,000 per cubic centimetre. Most of these white cells are embryonic in nature, thus, if the spleen and liver of patients suffering from this disease are exposed to the rays, the surplus white cells are readily destroyed, until their proportion in the blood becomes almost normal.

I hope you will all now realise what an enormous field of investigation is laid open in the application of radiology to veterinary medicine and surgery.

As a means of diagnosis I think its value is self-evident. It is as a therapeutic agent, particularly in the treatment of skin diseases. that the rays will prove of inestimable value to the veterinary surgeon, and it is my opinion that in this particular sphere the great value of the rays will become manifest.

There are many diseases of animals, both of the skin and of glandular structures which do not occur in man, and which I am sure have never been subjected to the effects of the rays. To those of you who are interested I would suggest that experiments be carried out with a view to finding those diseases which respond the most readily. I have no doubt that many such diseases exist and it needs only the careful and intelligent application of the rays to find them.

Discussion.

Mr. F. G. Edwards, F.R.C.V.S.: I should like to thank Dr. Higgins very much for his lecture. I have had three or four cases of leucocythæmia in dogs and they have always died, and I should like him to tell us the treatment in these cases.

Dr. J. B. Higgins, in reply: My knowledge as regards animals is nil. In the case of humans we treat the spleen and the liver. What I should do is to treat the spleen first, because that is generally the site of the trouble.

Mr. E. H. Curbishley, M.R.C.V.S.: Would Dr. Higgins please tell us about the cost? If we had to adopt it in the case of animals, would it be very expensive?

Dr. J. B. Higgins, in reply: What I would suggest is to have a central spot at which an X-ray apparatus is installed, and to which animals could be brought from surrounding districts. The nature of the apparatus required, of course, depends on the size of the animal; if you are going to deal with cows or horses you want a fairly powerful apparatus, but for dogs a less powerful apparatus would do.

Mr. E. H. Curbishley, M.R.C.V.S.: Smaller animals could be X-rayed in your own rooms. How much would it take for a case of eczema in a dog?

Dr. J. B. Higgins: One ought to cure a dog of eczema in about 12 applications, at a cost of about a guinea an application.

Mr. E. H. Curbishley, M.R.C.V.S.: May we take it that tuberculosis in bones, subjected to this treatment, is likely to recover completely?

Dr. J. B. Higgins: No, not in bones; only in glands.

Lt.-Col. J. W. Brittlebank, C.M.G., M.R.C.V.S.: I have no questions to ask, I merely rise to thank Dr. Higgins for what has been to me one of the most pleasant afternoons I have spent for a long time. Some years ago I tried to X-ray the large animals of the farm, but with little success. If you will recollect at that time no success could be obtained in taking radiographs except at very long exposures. At any rate, Dr. Higgins this afternoon has I think demonstrated to us veterinary surgeons quite clearly enough the enormous field which lies before a science which after all is but in its infancy. I would again express to Dr. Higgins our gratitude for the great amount of work he has expended.

Mr. E. H. Stent, M.R.C.V.S.: I have very great pleasure in endorsing what has been said with regard to Dr. Higgins. As has been pointed out by Mr. Curbishley it is very much a question of expense. For the purpose of dogs that have been injured by motors, etc., radiology of course is of very great service in discovering what otherwise is very difficult to diagnose, and we are always ready to adopt the X-rays for that purpose.

I would like to ask Dr. Higgins whether a bitch that is carrying puppies would show whether she was in whelp, also the number, and whether X-rays would have any effect on the young.

Dr. J. B. Higgins, in reply: In the human you can see certain bones in a little over three-quarter time, and you can more or less tell the position in the case of a single child. Of course if you have a litter of puppies it is going to be somewhat difficult. A mere single application of X-rays would have no ill-effects.

Mr. E. H. Curbishley, M.R.C.V.S.: Would it be possible, say in case of an internal hæmorrhage, to discover that there was a clot in any part of the body?

Dr. J. B. Higgins: Unless you got internal hæmorrhage in the lungs I am afraid you would not see it.

When it was mentioned at Stratford on July 17th that a veterinary surgeon's fee for attending the horse at the police station was 15s., and also 15s. for attending court to give evidence, Mr. J. Trumble (one of the justices) said: "I protest against those charges. A veterinary to get 15s. and a fully qualified medical man only gets 10s. 6d." He was told that it was the scale of fees laid down.

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FOOT AND MOUTH DISEASE.

La Clinica Veterinaria of June, 1922, is entirely devoted to the publication of a report on experiments carried out by Dr. G. Cosco and Dr. A. Aguzzi on Foot and Mouth Disease, from June, 1915 to October, 1919. The work was carried out on a Dairy Farm lent by the Crown and at the expense of the Government, the authors being entrusted with the control of a special method of vaccination against Foot and Mouth Disease.

The report, which runs to 140 pages, is divided into two parts, the first dealing with (1) the fundamental fact referable to the virulence of the blood of aphthous animals—and more particularly to the virulence of the red corpuscles; (2) the method of vaccination derived from this fact; (3) various correlative questions. The second treats of (1) microscopic researches, specially relating to the blood of animals suffering from the disease, and (2) some experiments on the localisation of the virus in certain organs.

The authors claim that their experiments have led them to a knowledge of certain new facts:

(1) the remittent type of the aphthous fever process, with daily rises of temperature;

(2) The determination of the conditions in which the virulence of the blood of infected animals, and more particularly that of the red corpuscles, is met with;

(3) The coincidence of the virulence of the red blood corpuscles with the presence in the latter of special corpuscular elements.

It is also claimed that the experiments have led to the acquisition of new views both in the practical as well as in the purely scientific field:

Practically: (1) As to the varying behaviour of the virulent red corpuscles of the blood inoculated by the intravenous and by the subcutaneous methods;

(2) As to the possibility of conferring on bovines a certain degree of resistance to the disease up to a state of immunity of the duration of at least three months, by means of intravenous treatment with the red corpuscles.

Scientifically, as to the existence of certain special corpuscular elements in the blood plasma and in the lymph of the eruptive manifestations.

Domestic Animals as a Factor in the Spread of Infection.

By WILLIAM SAVAGE, B.Sc., M.D. (Lond.), Medical Officer of Health, Somerset C.C.

(*Reprinted from the Journal of the Royal Sanitary Institute.*)

Real progress in the prevention of the spread of infectious diseases—using the term in its widest sense—can only be attained by an extension of exact knowledge as to the paths and methods of infection and the factors affecting the resistance of the individual. This truism is worth restating since it is so frequently neglected in practice. The present discussion only deals with one small aspect of this huge problem, but it is one upon which we need to come to clear and definite conclusions and to decide precisely to what extent, and how, domestic animals are factors of spread of infectious disease to man.

It would be impossible for me to give even a general survey of the subject in the time at my disposal, tuberculosis alone could occupy us for a day, so I propose to take three examples of alleged association between human and animal disease, leaving it to others to discuss other aspects of the subject. They are selected because I have devoted many years of investigation to them, and illustrate very well the need for exact knowledge which can only be acquired by prolonged investigation.

BOVINE MASTITIS AND HUMAN DISEASE.

Mastitis in cows is a rather common condition, and it is important to know definitely how far it is a menace to health. My own investigations and those of other observers show that it may be caused by a number of different bacteria. The chronic form is usually due to the tubercle bacillus or less commonly to actinomycosis. There is considerable discrepancy amongst authorities as to the prevalence of cows with tuberculous udders. There are evidently considerable differences according to the district. Probably the average prevalence is about 1 per cent. This is the most important source of tubercle bacilli in milk and a potential cause of human tuberculosis.

The association of the acute variety with human disease is far less direct and has required a good deal of unravelling. Of 35 acute cases which I investigated very thoroughly for the Local Government Board in 1907-08, over 70 per cent. were due to streptococci, the remainder being due to staphylococci (over 16 per cent.), one to *B. coli* and the others were of doubtful bacteriology. The point of practical importance in the present connection is the extent to which these streptococci and staphylococci are capable of causing human disease when ingested in raw milk. Since it is by no means infrequent for the milk from animals affected with acute mastitis to be added to the common supply and used for human consumption, I made an extended study of the streptococci from mastitis cases. The *streptococcus mastiditis* very closely resembles the pathogenic streptococci of man, as found in cases of sore throat and from

other sources, in morphological and cultural characters, but in my experiments differed in pathogenicity. This bovine type was of low virulence to animals but readily set up mastitis in goats. The human strains possessed considerable pathogenicity for laboratory animals, but 13 out of 15 strains were unable to produce mastitis in goats when introduced by way of the teat canal. The remaining two strains did produce some degree of mastitis in the goat. These results showed the striking and distinctive fact that there was an essential difference of function separating the two groups, and that it could be deduced that under ordinary conditions the *streptococcus mastitidis* is not a cause of human disease. So convinced was I of the accuracy of this deduction that on two separate occasions I infected my own throat with massive doses of this streptococcus, isolated only a day or two previously from cases of cow mastitis. On both occasions no ill effects were experienced constitutionally or locally, and the streptococcus could only be recovered with extreme difficulty from my throat, showing that it was a type of organism in an alien habitat.

While my extended investigations conclusively demonstrated that the ordinary case of bovine mastitis was not a cause of human disease, it left unexplained the undoubted fact that from time to time extensive outbreaks of sore throat and other septic conditions had been traced to milk infected from cows suffering from mastitis. In my book on "Milk and the Public Health," published in 1912, I summarised particulars of over 20 outbreaks of these diseases due to milk, in a good many of which the cause was traced back to cows suffering from this condition, while in 1905 I had described in detail, and fully investigated, such an outbreak involving over 600 cases and definitely traced to such an infective cow.

I was able to supply an explanation of this apparent inconsistency. While I found that *streptococcus mastitidis* was the usual organism of bovine mastitis, it was not the only type of streptococcus associated with this condition. In one case, for example, a streptococcus of extremely high virulence to rodents was found to be the cause of mastitis, and of a type which was distinctive from the *streptococcus mastitidis*.

In a paper I read in February, 1911, before the Epidemiological Section of the Royal Society of Medicine I advanced the view that the ordinary type of bovine mastitis is due to organisms non-virulent to man, but that in certain uncommon cases this condition is caused by streptococci highly pathogenic to man. In the same paper I propounded the hypothesis that the cases in which this type of organism occurred were examples of infection of the cow from a human source. To quote my words: "Briefly stated, I regard the bovine udder and teat lesions, as commonly met with, as of purely bovine origin and, as such, harmless to man. Occasionally, either as an invasion superadded upon the original bovine lesions or as a primary infection of the milk organs, there is a local infection with organisms of human origin. In such cases the conditions present may be decidedly prejudicial to man. In other words, the cow, in this class of infection, is only potentially pathogenic to man when it acts as an active or passive carrier of organisms of *human* origin."

These investigations and views were contained in papers written between 1907 and 1911. At that time there were no recorded outbreaks of sore throat, etc., reported in America, but in 1911 and subsequent years a number of extensive outbreaks occurred in Boston, Chicago, Baltimore, and other cities which led to an extended series of careful investigations in America which are of great value and have considerably increased our knowledge. They have, for example, been able to further differentiate the human type of streptococcus in bovine mastitis by means of hæmolytic tests, and have shown that the strains dangerous to man are always hæmolytic, while the streptococcus of ordinary bovine mastitis is non-hæmolytic. Davis and Capps have shown that hæmolytic streptococci of human origin may cause mastitis lasting for several weeks in cows, this time roughly corresponding to the duration of milk-borne epidemics. The streptococci may gain access from an infection from the milker, whose hands are contaminated, perhaps, from a sore throat.

By means of the tests advocated by me and these additional tests it is possible to state with reasonable exactitude whether particular strains of streptococci isolated from the udders of cows are of the human pathogenic type or are of the comparatively harmless bovine type.

In an outbreak in Boston in 1917 (reported January, 1920, by Brown and Orcutt), it was possible to identify the particular infective strain both from the mastitis fluid and from the sore throats of the sufferers. An endeavour was made to trace the source of infection of the cow, and this particular strain was isolated from the throats of a number of the employees of the dairy, but the data was insufficient to connect any one of these individuals definitely with the infection of the cow.

These American results afford very striking confirmation of the hypothesis described above, enunciate from my own investigations, and long before any of the American work was carried out. The precise relationship of this condition to human disease may now be said to be worked out fairly clearly.

Food-Poisoning—Outbreaks and Domestic Animals.

We now possess fairly exact knowledge of the relationship of unsound food conditions to individual cases and extensive outbreaks of food poisoning, but this knowledge is not widely disseminated while certainly it is not usually acted upon in administrative work. It is therefore worth while defining clearly the present stage of our knowledge.

We may accept it as definitely established that all, or almost all, the outbreaks involving groups of persons and probably most of the smaller outbreaks involving only a few individuals, are due to an infec-

tion of the food eaten with members of a particular group of bacilli, the Gaertner group, the infecting bacilli being either *B. enteritidis*, *B. suipestifer*, or *B. aertrycke*. The actual source of infection of the food is, in the majority of cases, not *intra vitam* from infected animals, but through secondary infection of sound food. In a minority, but still a very considerable proportion, it is due to infection of the living animal with one of these bacilli.

For the latter group of cases we need to arrive at an accurate conception of the nature of the diseases and conditions affecting domestic animals which may render them liable to originate outbreaks of food poisoning. Even yet we cannot answer this question with precision, but we do know a good deal about the conditions, both which do not and which do render the meat or milk a source of acute food-poisoning outbreaks.

Amongst those which do not we must place first, on account of its great administrative importance, tainted and putrefactive food. That such food causes attacks of food poisoning in individuals is usually assumed but the evidence is most unconvincing, and that it cannot originate widespread outbreaks is practically certain. To produce such outbreaks the food must be specifically infected with a member of the Gaertner group, and these organisms are not a cause of tainted food.

Apart from secondary infection of the food in course of preparation for sale or consumption, the only direct source of infection from an animal used for food is either when it is suffering from some form of disease associated with this group of bacilli or is acting as a carrier of these bacilli.

In only a few of the recorded British outbreaks is there direct evidence of disease in the animals supplying the peccant food. In several cases where milk has been the vehicle the condition has been traced back to infection of the cow with a member of the Gaertner group. The only two instances which I have been able to trace, spread by meat from a diseased animal, are those at Murrow and at Limerick. On the other hand, the continental outbreaks show this association much more frequently.

Animals used for food undoubtedly may be infected with these bacilli, the pathological conditions found being commonly gastro-enteritis, udder disease, puerperal sepsis, and local abscesses. We require a good deal more exact information as to the etiological association of these diseases. I have made a number of examinations but lack of material has limited my opportunities.

We have also to recognise that animals suffering from Gaertner group infections may recover from such conditions, but the bacilli persist, the animals acting as carriers, and undoubtedly a number of outbreaks have originated from the meat of sound animals being infected (by splashing, etc.) from the intestinal contents of such carrier cases.

I think I may claim that my protracted investigations carried out for the Local Government Board over ten years ago have completely refuted the idea which originated in Germany, and which was widely accepted when those observations were made, that these bacilli are normal intestinal inhabitants. The extensive work carried out since in this country, America, and Germany has fully confirmed these investigations.

In connection with the question of the secondary infection of food the importance of rats and mice must not be overlooked, since these animals frequently are infected with Gaertner group bacilli, and such infected animals, or those who have recovered and still harbour the bacilli, may act as a vehicle of infection.

It is therefore possible to have clear ideas as to the extent to which the domestic animals used for food may serve as a cause of food-poisoning outbreaks, and the lines along which we must institute our inquiries when they occur.

Diphtheria and Cats.

That cats may be attacked with human diphtheria, or act as carriers of the bacilli, and so spread this disease, is a view very widely accepted amongst medical men and in the text books.

Time will not allow me to discuss the experimental and other grounds for this view, and I must refer inquirers to my paper, published last February in the *Journal of Hygiene*, which deals with this and with my experimental work. This view has been kept warm and received considerable support from the reports published by Medical Officers of Health and others as to the finding of diphtheria bacilli in the throats of cats associated with cases of human disease.

My investigations were along three lines. The examination of the throats of healthy cats and kittens quite unassociated with cases of human disease showed that in the swabs from the latter no organisms like diphtheria bacilli were detectable, but that from no less than five out of eight healthy cats bacilli were found growing on the cultivation media, which, morphologically, very closely resembled diphtheria bacilli, and which could not be distinguished from that organism in the films from the cultures. One cat re-examined three months later still showed these organisms. When they were isolated and their characters studied in pure culture, it was manifest that they were not true diphtheria bacilli, nor were those tested pathogenic.

All the cases mentioned above, where diphtheria bacilli were reported as found in the throats of cats associated with human disease, rested upon morphological appearances alone and never upon isolation and identification, and, therefore, are completely valueless in view of the above findings.

My second line of enquiry was the examination of cats actually closely associated with human cases of diphtheria, and here, in several instances, as might be anticipated from my findings in healthy cats, bacilli morphologically indistinguishable from diphtheria bacilli were found in the cultures from the swabs. When isolated and fully investigated, however, none were found to be true diphtheria bacilli.

The third line of investigation involved the experimental inoculation of kittens, to see if it was possible to infect them with diphtheria bacilli by natural channels. As many as 19 different experiments were carried out, and 10 different strains of human diphtheria bacilli were used, the virulence of four of them being fully tested.

Massive and repeated feeding with highly virulent cultures (in one case on 11 occasions) were quite without effect. Kittens whose throats were inoculated by swabs with enormous numbers of diphtheria bacilli, either alone or mixed with staphylococci and streptococci, grown direct from human cases of diphtheria, remained unaffected, and the bacilli had disappeared within 24 hours. The possibility that the failure to infect the kittens was due to the absence of a local nidus of growth was met by creating such a nidus by a preliminary scarification of the throat, and with other animals by painting with strong silver nitrate solution. Subsequent massive inoculation with diphtheria bacilli still failed to produce any infection or, what was remarkable, any persistence of the bacilli locally. The same striking fact was brought out by a series of nose-swabbings with heavy doses of diphtheria bacilli. In every instance the bacilli rapidly disappeared, and neither local nor constitutional symptoms resulted. These results were exceptionally uniform and concordant. It was found impossible either to infect the kittens or produce a carrier condition, even one of very short duration.

The whole series of experiments justifies the opinion that the common and widely accepted view that cats can suffer from a naturally acquired disease caused by the diphtheria bacillus is entirely without foundation. The reported cases of such an association are based upon insufficient examination and differentiation of the bacilli found, due to a failure to realise that a large proportion of healthy, normal cats contain in their throats bacilli which closely resemble, and are difficult to distinguish from, the true *B. diphtheriæ*.

The above selected examples only illustrate a small part of the possible inter-relationship of human and animal infectious diseases.

I am convinced we do not utilise a great deal of available information which would be most helpful to both professions by our failure to secure extended co-operation between the medical and veterinary professions. We live and work far too much in watertight compartments.

Medical men are liable to draw hasty conclusions as to diseases in animals and their association with human diseases, which may be very incorrect, because they are imperfectly acquainted with the diseases of animals and the bacteriology of healthy animals.

The vêterinary profession fail to utilise as much as they might the detailed investigations of medical men upon human diseases, which would often throw light upon animal diseases, while I have the impression that they do not sufficiently consider animal diseases from the point of view of their possible relationship to human diseases.

Certainly, it is undeniable that if both combined together more than they do we should materially improve our knowledge of the relationship between human and animal diseases.

The Ghosts of Bath.

Beau Nash and his Company.

Charm of the Valley.

(Reprinted from *The Times*.)

Those who have never been to Bath—*non cuivis contingit adire Corinthum*—have learnt of its fame in books. For that reason, perhaps, they postpone a visit to it, unmindful that it is more than a monument or a museum or a hunting ground for antiquaries.

But it is a city which does not live entirely in the past. That should not be forgotten. It was fortunate in the Roman invasion. It played a memorable part in the social history of England. It was the place in which Beau Nash first proved himself to be a great reformer of manners—to be a man who, crowned with a white silk hat, ruled society with a prophetic sense and knew the power of humour in good governance. It was a place where royalties disported themselves, and lords and ladies—not always too lordly or too ladylike—lived in the finest mansions that the 18th century could build.

There is not an ignoble street in the old part of the city. Indeed, there is not a "street" at all. Every thoroughfare is a parade or a crescent, with here and there a court. It was a place where, for their sins, the elder aristocrats took the waters, and, it is to be feared not for their virtues, the young danced and frolicked. It was a place where, one can well believe, many a buck and beau might have whispered to a beauty:—

"Would you could make of me a saint,
Or I of you a sinner."

It displayed a strange mingling of the daintiness and the coarseness of life. Imagine a water festival in a tepid bath, the men in canvas waistcoats and breeches and the women in yellow robes with various coloured ribbons and their hair dressed with all the skill of a barber, "by appointment." Imagine, too, floating upon the waters little bowls of sweetmeats and cosmetics. Think of its company. Here Sheridan did his courting, Edmund Burke found a wife, Goldsmith ate Lord Clare's venison, Wordsworth attended his daughter's wedding, the other members of the Lake School dreamt of a pantisocracy, Sir Walter Scott went through "all the usual discipline of the Pump Room and the Baths." Lady Blessington and the Count d'Orsay and Walter Savage Landor were the guests of Napoleon III.; here—but the procession of ghosts, grave and gay, would stretch to the crack o' doom, and would include one that Thackeray made terrible:—

"An' if you and I had been alive then and strolling down Milsom Street—Hush! We should have taken our hats off, as an awful, long, lean, gaunt figure,

swathed in flannels, passed by in its chair, and a livid face looked out from the window—the great fierce eyes staring from under a bushy, powdered wig, a terrible frown, a terrible Roman nose—and we whisper to one another, 'There he is! There's the Great Commoner! There is Mr. Pitt.'"

NOT A NECROPOLIS.

Let us leave the ghosts there, although those of the Lydia Languishes and of the Lucius O'Triggers, and of satirists and punsters and erotic bards, and of men grown old enough to give good advice when they could no longer set bad examples, are yet to pass, as they pass by night through the shadows of an Irish capital which about the same period was the scene of like events. Bath must not be a city of ghosts. Nobody could wish that it should rest its fame solely on memories of kingly presences, of wealthy ailments, of "cures" of arthritic statesmen and ecclesiastics, of irresponsible love-making in times gone by. The company of shades is short-lived. It would make the city worthy of an equally short-lived visit. It would mean an inspection of a wondrous abbey with casual criticisms of its architecture, a glance at memorial tablets, and, often a few ill-informed tears on the close of a remarkable period in this country's annals.

Bath has not sunk, and, please Heaven, it will never sink, to the level of a necropolis. Nature would prevent that. Were all its literary and social associations to fade, were all the architecture of the two Woods to perish, it would still preserve the permanence of terrestrial beauty. Its hills clad with the elm, the sycamore, and the chestnut; its river, its parks, its countryside would still endure; and, whate'er befel, Providence would decree its rediscovery by a future race. It lies round a valley of rest, with a silence which is at once reminiscent and fatidic—reminiscent of these ghosts and fatidic that a time will come when out of the hurly-burly of industrial struggle there must emerge another phase of existence, there must be a resurrection of the grace of life. Merely to hobnob with ghosts and to stand bare-headed before the venerable tablets in the abbey is not to know Bath. It is not a city for a fleeting visit. It is a city to abide in; and of what other city can that be said?

Royal College of Veterinary Surgeons.

RESULT OF EXAMINATIONS, JULY, 1922.

LONDON:—

Class A.

A. J. Baxter*
W. G. Burgon
E. G. Conisbee
S. Datta
J. B. Griffiths
J. R. Hudson
V. B. Jones
G. H. Leader
P. C. G. Malkani*
P. N. Nanda*
W. Rhodes
R. A. Thrale
R. E. S. Tuckey
A. E. Wood
J. H. Wood

Class B.

A. A. Agarwala
G. R. Benbow
H. L. Boucher*
E. C. Bovett†
S. V. Collard
M. L. Dartnall
J. C. Davidson†
H. Davies
C. J. N. Godfrey
T. N. Gold*
G. N. Gould†
H. Hay-Barclay
R. S. Howe*
T. T. McGrath*
E. G. Morris
C. J. Pugh
D. E. Pugh*
J. C. Stephens
E. P. Thorne
K. D. Turner
E. Wilkinson*
R. McGregor
V. V. Morgan
L. E. Perkins
T. W. E. Pugh
H. C. Reeks*
A. Renfrew
C. Renfrew
J. V. S. Rutter
G. W. Searles
M. C. Sadler
A. Sams*
R. B. Smith
J. C. Wallace
H. C. Wilkins

Class C.

D. J. Anthony
A. J. Beeson
R. E. C. Bullen
M. G. Catmur
E. L. Clarke
L. J. Ford
A. V. Franklin*
C. J. H. Gale
J. McA. Gray
E. B. D. Hall*
C. P. Johnson
D. Johnston
H. P. Lightfoot
R. Lovell

Class D.

R. L. Cornell
A. F. Flood
E. W. Garry
D. A. Gill
H. C. Gregory
J. N. J. Hagan
H. L. Hobson
R. C. Holmes
R. T. Howells
T. Knowles
E. G. Langford
W. F. Loveless
H. Podgaez
T. J. Reynolds
H. P. Standley
E. Varley
E. Wilkinson

LIVERPOOL:—

Class A.

D. W. Mills
Z. Morcos†
A. Smith
R. T. Wiggins

Class B.

F. Beckett
J. Birtwistle
F. Booth
J. Brennan
A. J. Caldwell
H. S. Caldwell
E. A. Comer
B. Holmes
W. Nightingale
A. C. Shuttleworth
L. A. Watson
T. W. Woodhead

Class C.

E. D. Barker
A. F. Butler
G. D. Coward
G. O. Davis*
K. D. Downham
B. Gale*
A. W. Holtum*
T. W. Hughes
D. L. James
E. G. Knight (Miss)
R. C. Locke
E. L. Taylor*
J. W. Wilson

Class D.

A. M. Fulton
C. Hargreaves
H. R. Hewetson
E. F. Manley
H. T. Matthews
A. E. Proctor
A. W. Whitehouse

* Denotes 2nd Class Honours.
† Denotes 1st Class Honours.

(To be continued.)

Abstracts and Reviews.

Cattle Disease in West Africa.

An interesting article has appeared in the *Halle aux Cuirs* on cattle diseases in West Africa. M. Panisset, a professor at the veterinary school at Alfort (France) speaks with authority. "Cattle plague," he writes, "attacks ox, zebra and buffalo. Goats, sheep and pigs have been known to contract the disease, but only on rare occasions." M. Panisset has come to the conclusion that not every animal falls a victim to a passing epidemic. "For instance," he says, "herds may be feeding together, and while one lot may succumb, the other may remain immune." He quotes Indo-China, where a short while ago herds of buffalo died, other cattle in the same region being left healthy and sound. Cattle plague, according to the professor, may be conveyed to an area by several means. As it is a contagious disease, infected animals may carry it from one district to another. M. Panisset in his researches has found that a certain delay exists between the time a beast is infected and the period when the sickness shows itself. It is generally some days, four or five perhaps, before the animal's condition shows the usual symptoms. One difficulty which the professor has found in his search for virus in the diseased animal is that the virus dries up too quickly for it to be of much use. Naturally, the amount procured has to be economically dealt with, and every care taken to preserve it. The professor, in dealing with quarantine, mentions methods by which cattle-owners have tried to combat the plague. "The English," he writes, "have endeavoured to close up the infected area by removing all cattle from that particular ground. But that system has not always been successful, because game have found been carrying germs from this area to another." In spite of many discouragements, the professor is hopeful of eventually destroying this plague germ. Isolation, he contends, has done much, and will do more. Barrages, cordons drawn around infected districts, and strict sanitary measures, if they do not eradicate the disease, will arrest its progress. What M. Panisset would like to see established would be centres in West Africa where veterinary doctors were stationed, and where serum could be produced. An army of fully-qualified men, who could act as sanitary agents, "would," he assures us, "so combat plague that West Africa in time would become a great cattle-producing country."

Antiscorbutic Value of Dried Fruits.

Experiments were made by Eckman (*Journ. Amer. Med. Assoc.*, March 4th, 1922) to determine to what extent, if at all, the antiscorbutic vitamines are contained in dehydrated fruits. The experiments consisted in feeding observations on guinea-pigs. The dried fruits used were peaches, apricots, apples, pears, prunes, cherries, and loganberries. Water and alfalfa-flour mixture were given *ad libitum*, and varying amounts of the fruit were used. When scurvy symptoms were prominent and marked loss of weight occurred, the amount of fruit was increased in the effort to prevent a fatal issue of the disease. *Post-Mortem* examinations of practically all of the animals were made, and in all cases definite evidences of scurvy were observed, such as subperiosteal hæmorrhages, especially in the limbs and cheeks, evidence of intramuscular and subcutaneous hæmorrhages, hæmorrhagic nodules at the costochondral junctions, and enlarged and hæmorrhagic suprarenals. The principal *ante-mortem* signs were marked loss of weight and appetite, subcutaneous hæmorrhages, marked pseudo-paralysis of the limbs, and in one case (on apples) a prolapse of the rectum. From these experiments it appears evident that the only one of the dried fruits tested which contains sufficient antiscorbutic vitamin to maintain the life of a guinea-pig when fed in not too excessive quantities is the peach. Of this fruit it appears that four grams a day, although insufficient to prevent scurvy, delays it for three or four months. Although further trial did not bear it out, earlier experiments indicated some value in apricots and apples. Pears, prunes, loganberries, and cherries seemed to have even less value.—(*British Medical Journal.*)

The Anti-anaphylactic Action of Lipoids.

Duprez (*C.R. Soc. Biologie*, February 4th, 1922) shows how it is possible to prevent the symptoms of acute anaphylactic shock in the guinea-pig by means of the previous injection of a lipoidal emulsion. The particular lipoids used are prepared by making an alcholic extract of a calf's heart which has been treated preliminary with acetone. After evaporating the extract to dryness, the residue is dissolved in saline. The guinea-pigs are sensitised by the subcutaneous injection of 2 c.cm. of horse serum. Three weeks later a determination is made of the minimal lethal dose of horse serum given intravenously. If now, one hour before the dechaining dose is given, an injection of 2 c.cm. of the lipoidal emulsion be administered intravenously, all symptoms of shock are prevented. Not only is this method successful in protecting against horse serum anaphylaxis, but it appears to be equally efficacious in warding off the symptoms produced by other substances normally capable of giving rise to shock in the guinea-pig, such as serum treated with agar or a suspension of agar in physiological saline. The mechanism of this effect has not yet been worked out.—(*British Medical Journal.*)

Mange of the Ears in Rabbits.

Mange of the ears in rabbits is caused by *Psoroptes communis*, and is visible at first only by a minute yellowish crust deep down in the auditory tract. The animal holds its head down with the ear always lowered. At this stage the disease is easily cured by injecting a few drops of olive oil or tobacco extract with a small syringe. For this purpose, tobacco is used at the rate of 3 oz. to five pints of water, reduced to one-third by boiling. For a more advanced stage, a mixture of one tablespoonful of carbolic acid to two tablespoonfuls of glycerine in one-and-a-half pints of water is advised. A simple remedy for the disease in any stage is a mixture of one part of potassium pentasulphide to five of water, injected warm after filtering; or a warm solution of 3 per cent. cresyl, mixed with two parts of oil and one part oil of turpentine. This form of mange is very contagious not only in rabbits, but in other animals, particularly horses. Seriously infected animals should therefore be killed. As *P. communis* is killed by a temperature of 95° F., the hutches can be disinfected by washing them down with boiling water.

Sarcoptic mange, caused by *Sarcoptes scabiei* var. *cuniculi*, and the form caused by *S. notoedres*, begins in the head, generally about the nose, and gradually covers the face and ears, sometimes the paws, and occasionally the whole body. It appears in the form of a greyish crust, very thick and adherent, covering a thickened, inflamed and bleeding skin, with much discharge. The animals become very thin, and sometimes die. The skin should be shaved and washed with warm soapy water, followed by applications of Helmerich's ointment, cade (juniper) oil, or balsam of Peru at a strength of 1 : 8.

[Gabert (H.). Traitement des Gales du Lapin.—*Vie Agric. et Rur., Paris*, xix, No. 53, 31st December, 1921, pp. 473-474, 2 figs. Ex. *Rev. Applied Entomology.*]

Beetles as Food and Medicine.

This paper reviews existing information regarding beetles used as food and medicine. The Meloidæ are the group chiefly concerned as regards medicine, the blister-beetles of the genera *Epicauta*, *Lytta*, *Lydus*, *Meloë* and *Mylabris* being well known in this connection. The use of certain insects as food is based on the flavour imparted by the irritant principle in them, while many larvæ with a high fat or albumen content are a valuable addition to the diet of vegetarian races of man.

[Netolitzky (F.). Käfer als Nahrungs- und Heilmittel. (Beetles as Food and Medicine.)—*Koleopt. Rundschau, Vienna*, vii., No. 9-10, 25th February, 1919, pp. 121-129; viii, No. 1-3, 20th September, 1919, pp. 21-26, 47-60. Ex. *Rev. Applied Entomology.*)

Clinical and Case Reports.

The Editor will be glad to receive from members and others contributions to this column of reports of interesting cases.

Lamb Dysentery.

By R. Craig Robinson, M.R.C.V.S., Carlisle.

A client of mine who has a large sheep farm situated on the English borders adjoining Roxburghshire has, during the last few years, had a large mortality amongst his lambs from the above disease.

My client consulted Professor Gaiger on the matter, who advised vaccination and supplied sufficient vaccine to vaccinate 49 sheep, viz., 45 ewes and four gimmers.

The vaccination was first applied on March 17th, when 2 c.c. of vaccine were inoculated into each sheep. They were again vaccinated on the 29th March with 3 c.c. The after-effects of the vaccination were practically nil, only a few ewes showing slight stiffness in the leg in which they had been vaccinated. The results have been most gratifying, as only two lambs out of those ewes and gimmers have died from the disease, viz., the lamb of one ewe and of one gimmer. These ewes were grazed along with a large number of other ewes on the adjoining hirsels which were not vaccinated, and there was a large mortality amongst those unvaccinated.

As these ewes were vaccinated as an experiment, and the results have been so highly satisfactory, my client intends if he can procure the vaccine to inoculate a larger number next year.

Tuberculous Meningitis.

By G. V. Byrne, M.R.C.V.S., Streatham Hill.

Subject.—Cow, six years old. On Sunday, March 19th, mid-day, I received a telephone message from the owner of this animal asking me to go and see a cow which he thought had pneumonia, as she was panting greatly and off her feed. On my arrival the owner told me he was convinced her lungs were very bad.

Symptoms.—On examination I found the lungs to be normal, respirations markedly increased, pulse quick and wiry, temperature 105·5°, both pupils dilated, and partial blindness; the bowels were normal, and apparently the rumen and other stomachs in a fairly good state. The head was held very stiffly, and inclined to one side. There was slight twitching of the muscles, with spasmodic movements of both hind legs. The animal was tied up, and on releasing her, and persuading her to walk, she showed a marked tendency to walk in circles, more particularly to the left side, and pronounced inco-ordination. On looking at her from a distance one would be inclined to think from how the head was held that she had sustained some injury in the cervical region, but on palpation this was found to be incorrect. The point upon which I here wish to lay stress is that the cow was in excellent condition, had never been ill before, and showed no symptom of tuberculosis. At first I was rather inclined to think it was a case of lead poisoning, but the history of the case was absolutely against this, and I then came to the conclusion it was a case of tuberculous meningitis. I then told the owner that treatment would be useless, but this did not satisfy him, and he wished to have her treated at least for a time to "give her a chance."

Treatment.—Mag. sulph. to be given in a quart of lukewarm water, and 1½lbs. of treacle, along with one of the following powders, four of which were given:—ammon. carb. and p. camphoræ aa. ℥iss. antifebrin, ℥ij., digitalis, ℥iss., sodii bicarb. and gentian aa. ℥iss.

On the following day I again saw the cow. Symptoms were the same as the previous day, temperature 105°, and the brain symptoms even more marked. Bleeding from the jugular was now resorted to, and a second dose of mag. sulph. given—℥x. After this the cow seemed somewhat easier, but the bowels had not moved. On the following day I had a telephone message to say the cow was down, could not get up, and that there was complete abeyance of the appetite. I again saw her and found she was semi-comatose, and advised the owner to have her slaughtered; but this he would not consent to do. He fed her on oatmeal gruel, linseed meal, and, in fact, any mucilaginous food he could obtain. I went to see her next day, and found, to my amazement, she looked a great deal better. Breathing was fairly normal, temperature still elevated, 104·5°, and the head held in almost the natural position, but still she refused to feed. Next day I was informed she was much worse, and I went again, only to find the animal down, unable to rise, respirations increased, grunting, eyes staring, pupils dilated, bowels still unmoved, and the head held stiffly, and to one side; temperature had fallen to 99°. I again told the owner it was useless to continue with the case, so he consented to have her slaughtered.

Unfortunately, I had not an opportunity of examining the carcase, as the animal went to a knacker, and was disposed of before I could get there; but I had the brain kept.

On macroscopic examination I found the corpora quadrigemina and the meninges of the part to be very acutely inflamed, also the choroid plexus. The ventricles showed nothing abnormal, nor did any other part of the brain.

I sent the brain to the R.V.C., London, for examination, and from there I was informed that *B. tuberculosis* had been easily demonstrated in the above lesion.

The Week at Westminster.

By Our Parliamentary Correspondent.

Sir A. Mond, the Minister of Health, in moving the Second Reading of the Milk and Dairies (Amendment) Bill in the House of Commons last week, said its object was to improve the supply, and particularly the purity, of milk in a less ambitious and expensive way than was contemplated by the Act of 1915, the operation of which we suspended during the war, but which, if the present Bill were

not passed, would automatically come into force on September 1. The Bill, which had already passed through the House of Lords, was the result of very careful consultation between the Ministry of Agriculture, the Central Chamber of Agriculture, the Farmers' Union, the leading producers of high-grade milk, and all those who had taken most interest in the clean milk question. The measure had met with the approval of all those somewhat conflicting interests. The consumers' point of view had also been very carefully considered.

Describing the provisions of the Bill in detail, the Minister said that the measure proposed to give local authorities the power to take a retailer off their registers, thus giving better supervision and control. He was endeavouring in the Bill to work on a method of grading up milk. There were at present 35 grading stations, which were properly controlled and in which a very strict inspection was made with tuberculin tests in regard to the cattle used. He proposed to try and provide a system under which a reasonably careful farmer ought to be able to supply the certified grade and grade A milk without any great additional cost to himself. Pure milk should be no longer the luxury of the rich, but it should be made a common commodity for the use of all citizens. Dealing with the tuberculin tests for cattle, the right hon. gentleman said that what was wanted was milk which was free from tuberculous bacteria. It was not the case that every cow which reacted to the test gave tuberculous milk. At present the Medical Research Council, at his instigation, was carrying on an elaborate investigation into the whole question of the value of the tuberculin tests. He proposed to go on the lines of testing the milk rather than the cow, and he was laying down a standard of a bacteriological kind in the milk test rather than dealing with the animal which was producing it.

In Clause 4 of the Bill provisions were introduced for prohibiting the addition of colouring matter or water and other similar things to milk, and it was made an offence to sell, offer or expose for sale adulterated milk. Under Clause 5 it was made an offence for any person knowingly to sell milk from a cow with tuberculosis of the udder. For the first summary conviction there was liability to a fine not exceeding £20, and for second and subsequent convictions a fine not exceeding £100 or imprisonment with or without hard labour for a period of six months. The penalties were purposely made severe because a person selling milk of that kind was retailing not food but poison, and committing a crime against society. Whether it would be possible to deal with the standard of condensed milk he could not say, because he had not considered all the details, but the Ministry was anxious to see that the best condensed milk was brought into this country. Unfortunately, the very considerable powers under milk and dairy Orders had in many cases not been exercised. Under Clause 11 of the Bill, where the district council failed to perform their duties, the Minister might order that such powers and duties should be transferred to the county council.

In the debate which followed, SIR WATSON CHEYNE said that the presence of the word "knowingly" in the provision that "no person shall knowingly sell or offer or expose for sale the milk of a cow suffering from tuberculosis of the udder" left a loophole for evasion which almost destroyed the value of the clause. He could not see why it should not be as necessary for a dairyman to know that the milk which he sold did not contain tubercle bacilli as it was for a restaurant-keeper to know that the food which he supplied would not cause ptomaine poisoning. Further, the reference in the Bill to disease of the udder would cause dairy farmers to concentrate attention on the question whether the udder was tuberculous—a matter difficult to diagnose—rather than on the question whether the milk contained tubercle bacilli, which could be determined quickly, cheaply, and with certainty by microscopic examination. If a milkman were to sell milk diluted with arsenic it would be said "What a terrible thing to do," although it might have been accidental. Why, then, should a milkman be allowed to sell milk containing the bacilli of tuberculosis?

MR. MYERS, a Labour member, said that there was a very simple provision in the Act of 1915 which ought to be included in this Bill. Some local authorities had already adopted this provision, and employed a veterinary surgeon, whose duties were to inspect dairy cattle in their area once or twice a year. There was no law to compel them to undertake this work, but in the 1915 Act there was a provision whereby a number of authorities might combine for that purpose, employ a veterinary surgeon, and set him looking after the dairy cows in that way. In those parts of the country where this principle had been adopted there had been a general advance in the type of dairy cows kept, and there had been a lower type of animal where this inspection was not in operation. Such inspection should be made general.

SIR A. MOND, replying to points raised, said that it had been stated that it was practically impossible to diagnose tuberculosis of the udder. He had discussed this question with veterinary experts and practical farmers, and he was told that the diagnosis was by no means so difficult as it was made out to be. Giving a rough outline of the intended grading proposals, he said that every animal would be subjected to the tuberculin test before being admitted to the herd and certified as a non reactor. Every three months the herd would be examined by a veterinary surgeon, and the milk examined for tubercle bacillus. If there was evidence of tuberculosis the animal would be withdrawn from the herd. If the milk from the group showed evidence of tuberculosis the whole group would be withdrawn until the affected animal was identified. Milk was to be bottled on the farm immediately after production, and delivered to the consumer within two days of production. Bottles were to be completely sealed before delivery, and must not contain more than 30,000 bacteria per cubic centimetre or any bacillus coli in a tenth of a cubic

centimetre. This was for certified milk, and in the case of Grade A milk, the health of the herd was to be the same as with certified milk, except that there would be no tuberculin tests. The milk might be pasteurised, but if so it must be designated. It must not contain more than 200,000 bacteria per cubic centimetre. Those limitations involved the use of sterilized vessels, with careful regard to cleanliness, especially to ensure freedom from manurial contamination.

The Bill was read a second time.

FOOT-AND-MOUTH DISEASE.

At question time CAPTAIN ELLIOT asked the Minister of Agriculture whether, during the recent epidemic of foot-and-mouth disease, any outbreaks were traceable to re-infection of fresh stock in previously infected premises; and, if so, how many.

SIR A. GRIFFITH-BOSCAWEN said that he was satisfied that in two cases only, out of a total of some 1,150, had outbreaks of foot-and-mouth disease been attributable to the re-infection of fresh stock on previously infected premises after they had been closed for the prescribed period.

SUFFERINGS OF IMPORTED CATTLE.

CAPTAIN WEDGWOOD BENN asked the Minister of Agriculture what regulations existed to prevent unnecessary suffering during the voyage of live cattle imported into this country, and whether such regulations were effective?

SIR A. GRIFFITH-BOSCAWEN replied that regulations for the protection of animals from unnecessary suffering during the voyage to this country were, as regarded animals from abroad, contained in chapter 6 of the Foreign Animals Order of 1910, and as regarded animals from Ireland, in Part I of the Animals (Transit and General) Order of 1912. Judging from the inspection of the fittings in the vessels engaged in this trade and the number of casualties reported, he was satisfied that the regulations were as effective as could be expected, but a certain amount of suffering was unavoidable in the case of voyages across the Atlantic.

CATTLE FROM IRELAND.

SIR A. GRIFFITH-BOSCAWEN informed Mr. Wise that the number of cattle, sheep, and swine imported into Great Britain from Ireland in 1920 and 1921, with the estimated value of the imports in 1920 (compiled from reports published by the Department of Agriculture and Technical Instruction for Ireland) was as follows:—

	1921.	1920.	
	No.	No.	Estimated value.
			£
Milch cows ...	31,724	47,001	1,884,898
Other cattle ...	697,566	852,547	33,319,095
Calves	39,201	27,290	409,350
Sheep	224,714	245,525	1,471,022
Lambs	342,254	346,291	1,350,535
Swine	65,854	166,869	2,455,083

Notes and News.

The Editor will be glad to receive items of professional interest for these columns.

The Third International Congress on the History of Medicine was held from the 17th to the 22nd July at the Royal Society of Medicine, 1, Wimpole Street. In addition to the sessions for the reading of papers on various historical subjects in the realm of medicine, pharmacy and veterinary science, visits were arranged to the Wellcome Historical Medical Museum, the Royal College of Physicians, the Royal College of Surgeons, the Barber Surgeons Hall, and St. Bartholomew's Hospital. Among the papers on the History of veterinary science the following were read:

By Maj.-Gen. Sir F. Smith: on the History of Veterinary Anatomy in England in the 16th, 17th, and 18th Centuries.

By Mr. F. Bullock (Secretary, R.C.V.S.), on the "Mulomedicina Chironis," a fourth century veterinary compendium, of which only one MS. copy has been found.

By Monsieur H. Sevilla, a Veterinary Surgeon of Paris, on the Description of the Symptoms of Colic in the Greek Hippiatrika.

By Prof. F. J. Cole, on Ruini's Anatomy of the Horse.

By Monsieur L. Moulé (Paris) on the *Malis* of the Greeks and the *Malleus* of the Romans.

Obituary.

BALLS, GEORGE. Brixton Hill, S.W. Graduated London, 17th April, 1871. Died, 18th July, 1922. Aged 73.

BASSET, P. T. B. Cowbridge, Glamorgan. Graduated London, 12th July, 1900. Died 9th July, 1922.

ELPHICK, GEORGE. Newcastle-on-Tyne, Northumberland. Graduated Edinburgh, 13th April, 1871. Died 19th July, 1922. Aged 73.

MOLYNEUX, N. New Kent Road, S.E. 1. Graduated London, 23rd April, 1872. Died 13th July, 1922. Aged 76.

THORNE, H. A. South Molton, Devon. Graduated London, 22nd December, 1914. Died, 28th June, 1922. Aged 40.

WOLSTENHOLME, J. B. Quay Street, Manchester. Graduated London, 1st April, 1875. Fellow 26th April, 1893. Died 16th July, 1922. Aged 72.

Lancashire Veterinary Medical Association.

A General Meeting of the Lancashire Veterinary Medical Association was held at the Grand Hotel, Aytoun Street, Manchester, on June 21st, 1922, at 3.30 p.m. The chair was taken by the President (Captain F. Hopkin), and the other members

present were Messrs. Allen, Burndred, Brittlebank, Curbishley, Edwards, Locke, Lancaster, Noel-Pillers, Stent, Taylor and Whitehead. Visitors, Messrs. Craig and Prescott.

Aplolgies for unavoidable absence were received from Messrs. Abson, Carter, Mayall, Spruell and Woods.

It was unanimously resolved that the minutes of the last meeting be taken as read.

Correspondence.

A letter from Mr. G. Ellis, M.R.C.V.S., Glossop, tendering his resignation as a member. Proposed by Mr. W. A. TAYLOR, F.R.C.V.S., seconded by Mr. J. D. WHITEHEAD, F.R.C.V.S., and unanimously resolved, that the resignation be accepted with regret.

Election of Council of the Royal College of Veterinary Surgeons.

LT.-COL. J.W. BRITTLEBANK, C.M.G., M.R.C.V.S., intimated that a letter had been received from Major J. Abson, F.R.C.V.S., in which he thanked the Association for its support. Lt.-Col. Brittlebank also thanked the members of the Association for the support which had enabled him to be re-elected as a member of Council.

Nominations.

The following gentlemen were nominated for membership of the Association :—Mr. E. A. Pearce, M.R.C.V.S., Northwich, Cheshire, by Lt.-Col. J. W. Brittlebank, C.M.G., M.R.C.V.S.; Mr. Thomas Craig, M.R.C.V.S., Grosvenor Street, Manchester, by Mr. G. H. Locke, M.R.C.V.S.

Dr. J. B. Higgins, M.B. (Vict.), D.M.R.E. (Camb.), Manchester, then addressed the Meeting on "Some aspects of Radiology, with Suggestions for its Application to Veterinary Surgery." [Dr. Higgins' paper, together with the ensuing discussion, receive separate publication.—*Ed.*]

CAPT. F. HOPKIN, M.R.C.V.S., in proposing a vote of thanks to Dr. Higgins, said :—I think we have got to thank Dr. Higgins for coming here and expending the time he has done. He gave his services very readily, and I am sure we have all appreciated his lecture, and I want you to show your appreciation in the usual way.

LT.-COL. J. W. BRITTLEBANK, C.M.G., M.R.C.V.S. I am quite sure the Lancashire Veterinary Medical Association will only be too glad if Dr. Higgins will come amongst us on future occasions.

Dr. Higgins in reply :—I shall be only too pleased to come amongst you at all times, and if I can be of any service I shall be only too pleased. Radiology is a very difficult subject to speak about, but if I have conveyed the lines of investigation to you, I shall consider that my mission has been fulfilled. (Applause).

JOHN SPRUELL,
Hon. Secretary.

Correspondence.

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.
All correspondence must bear the name and address of the contributor for publication.
The Editor does not hold himself responsible for the opinions of his correspondents.

Veterinary Inspectors' Fees (and Allowances).

SIR,

I have been much interested in the matter in your Correspondence Column respecting the above and consider the Chairman of the Suffolk Veterinary Inspectors' Association is, in the first place, to be congratulated on obtaining an increase of fees during "hard times," but, at the same time, I think that the scale is open to what I trust he and his Co-Inspectors will understand to be only of the nature of a friendly criticism. Surely inspection of Markets and Sales is worth a minimum fee of £1 1s. 0d. (though I do not know quite how it is conducted). Microscopical examination I also consider worth an equal fee (mange parasites—especially after an animal has been well dressed—I find quite as elusive as bacteria).

Ordinary visits, mallein test, foot and mouth, speaking generally, seem good, but why is no differentiation as to numbers made in respect of Sheep Scab where, according to our instructions, we have to inspect all sheep on the premises exposed to infection frequently running into numbers of 250 or more?

Again, surely 6d. a mile (distance actually travelled—presumably mileage both ways) is insufficient travelling allowance, or else the veterinary inspectors of these parts are wrong in protesting against 7½d. and requesting 9d.

However, the veterinary inspectors of Suffolk do not seem to have had imposed on them the graduated scale of allowances referred to in your last issue as offered to ourselves.

This scale has, to my mind, a remarkably repellant similarity to a scale of fees issued, I believe, to the local veterinary inspectors of the Ministry of Agriculture and upon which I adversely commented sometime ago. Perhaps such was a Treasury order. I trust if this scale is attempted to be forced on veterinary inspectors there will be general resentment throughout the profession.

Surely it would be well to know the position of veterinary inspectors throughout the country. There is a Suffolk Veterinary Inspectors' Association, there is a Veterinary Inspectors' Section of our own Association, and we in our wisdom have applied to the National Veterinary Medical Association for redress.

Is the National Association of Veterinary Inspectors alive or dead?

There may be much arising in connection with veterinary inspectors immediately and in the future in which we require to be thoroughly organised from A to Z. It seems to me we need some central body to advise us regarding prospective legislation, to apply to for redress, and to co-ordinate or assist in co-ordinating our fees.

I am,
Yours faithfully,
HUGH P. HOGBEN.

26, Manor Park Road, Folkestone.
July 11*th*, 1922.